Ethnic and Specialty Vegetables Handbook

Second Edition

Stephan Tubene and R. David Myers
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PREFACE

Tobacco farming in Southern Maryland has been a way of life for decades. This farming practice is changing rapidly. Maryland Department of Agriculture (MDA)’s tobacco buy out program has encouraged Maryland farmers to explore alternative crops, which could substitute tobacco in Maryland, especially in Southern Maryland, formerly known as the “tobacco country.”

Consumer tastes and preferences drive the nation’s food and fiber system, along with other common determinants of demand such as the number of sellers, the price of related food items, and consumers’ income. In fact, changing patterns of the U.S. agriculture and population will definitely influence next generation’s food demand.

This publication is the result of alternative crops’ field trials in Southern Maryland weather and geo-climatic conditions. Thanks to an initial grant from Tri-County Council for Southern Maryland, and MDA specialty crops grant, the ethnic and specialty vegetables production project was started at the University of Maryland’s Research and Education Center in Upper Marlboro.

While the first edition of the Ethnic and Specialty Vegetables Handbook focused on ethnic vegetables production itself, the second edition adds best production practices for ethnic and specialty vegetables including plasticulture, low and high-tunnel production methods. We believe that this new edition will provide valuable production guidelines to our farmers and growers of ethnic and specialty vegetables.

Additional information on ethnic and specialty vegetables can be obtained by calling your local University of Maryland Cooperative Extension office, or by calling us directly at 410-222-6759. You may also visit the Small Farm Institute web site http://extension.umd.edu/agriculture/smallFarms/index.cfm or browse the Maryland ethnic and specialty vegetables web site www.marylandethnicvegetable.com.
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ABBREVIATIONS AND ACRONYMS

AGNR Agriculture and Natural Resource
CMREC Central Maryland Research and Education Center
DRC Democratic Republic of Congo
FS Fact Sheet
IPM Integrated Pest Management
MCE Maryland Cooperative Extension
MDA Maryland Department of Agriculture
U.S. United States of America

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INTRODUCTION

Specialty and ethnic vegetables are defined as vegetables and /or herbs that were not traditionally grown in the U.S. but were imported to the U.S. and are currently grown on a limited scale. Sometimes, ethnic and specialty vegetables are referred to as exotic, unusual, world vegetables, and/or high-value crops.


All vegetables discussed in the Handbook were experimented at the University of Maryland’s Central Maryland Research and Education Center (CMREC), Upper Marlboro Facility.

Previous work on ethnic and specialty vegetables at the Small Farm Institute includes a FS 783 titled “Agricultural and Demographic Changes in the Mid-Atlantic Region: Implication for Ethnic and Specialty Produce.” In this publication, several questions were raised regarding the survival of the mid-Atlantic farmers in the midst of recent agricultural and demographic changes. It was suggested that Mid-Atlantic farmers were to adapt to these changes in order to survive in such a competitive environment. Adapting means examining and adopting (new) alternative crops and marketing strategies, namely high-value crops, value-added enterprises, agritourism, farmers’ markets, and pick-your-own.

While this initial publication on ethnic and specialty vegetables introduced U.S. agricultural and demographic trends, and their implication for the farming communities, subsequent publications have focused on production guidelines, nutritional values, and market potential for ethnic and specialty vegetables in the mid-Atlantic region, which are accessible at the Maryland ethnic vegetables Web site www.marylandethnicvegetable.com

While this Second Edition of the Ethnic and Specialty Vegetables Handbook is not the sole reference book on world vegetables, it however serves as a reference among other publications on the subject. The authors of this publication welcome any suggestions and useful information on ethnic and specialty vegetables that can be included in future publications.
PLASTICULTURE PRODUCTION METHOD FOR SPECIALTY VEGETABLES

The ethnic and specialty vegetables and herbs investigated at the Central Maryland Research and Education Center, Upper Marlboro Facility 1999-2006 were species that typically are cultivated in the tropical regions of Africa, South America, India and the Caribbean. Hence, these vegetables thrive under hot growing conditions that occur in Maryland from the first week of June through the end of August, with the majority of mature fruit produced in the long hot days of July. This Maryland study has proven that the plasticulture techniques which utilize black plastic covered raised beds and trickle irrigation greatly enhanced production success for these specialty vegetables. With the utilization of plasticulture specialty vegetables and herbs may be successfully planted in mid-May to provide a range of harvest dates from Mid-June to September, as revealed for the twenty-seven vegetable species or varietals examined. Refer to the production report entitled: Ethnic Vegetable Production Trials on a plasticulture System for the Development of an Ethnic Food Market in Southern Maryland, (Myers and Tubene et al 2001).

The plasticulture system approach requires a conventionally tilled field, that allows a bed maker to gather soil into a 6-8” raised bed that are 30” wide on 5’centers. Bed making and the laying of plastic may be combined in one pass when the desired height of the bed is not required to exceed 4 inches. However, it is recommended that for higher beds, make a pass to initially form the bed followed by a second pass to lay the plastic and install the trickle irrigation tube. The raised plasticulture bed should be firmly crowned to shed water with a plastic to soil contact that is free of soil voids; Thus allowing solar heat to be effectively transferred to deeper reaches of the soil promoting faster and uniform early growth. Trickle irrigation systems require clean water that is filtered to avoid emitter plugging. Ponds or dedicated irrigation wells are required to irrigate fields that are larger than one acre in order to provide sufficient water volume. Trickle irrigation tubing is capable of high water volume delivery at a low operating pressure range from 6-12 pounds per square inch. For more information concerning the design and operation of trickle irrigation obtain a copy of the University of Maryland Extension Bulletin 356 Trickle Irrigation for Cut Flowers, Vegetable, and Small Fruits, (Ross 1997).
The plasticulture system should also incorporate an integrated pest management (IPM) system approach. For key pests IPM emphasizes the utilization of primary pest control tactics such as: selection for plant resistance; habitat alteration via cultural practices; direct mechanical pest intervention; and classical biological release or augmentation of beneficial organisms. When the combined primary tactics fail to keep a pest population below an economic injury level then a prescriptive chemical application is warranted as a secondary pest control tactic. Pest management economic thresholds for insects and weeds are published for vegetables and field crops in the University of Maryland, *Pocket IPM Threshold Guide*, (Myers 2000).

Application of herbicides to the soil under the black plastic is not recommended for specialty vegetables. However, herbicides should be post directed to the soil between the plasticulture beds, applied after the plastic is laid and prior to transplanting the vegetables to reduce weed growth. Any herbicide on the plastic bed surface should be rinsed off by timely rainfall or overhead irrigation prior to transplanting.

Hardened transplants were produced for the study at the University of Maryland greenhouse. The process of growing hardened and conditioned transplants that are ready for field conditions is fully described in the following University of Maryland Fact Sheets: FS 551 Growing Vegetable Transplants, (McClurg 2001) and FS 552 Hardening Vegetable Transplants, (McClurg 2001).
Vegetable transplants may be planted by hand or with the aid of a water wheel transplanter. A water wheel transplanter punches the plastic, applies water and allows the placement of plants from a sitting position by the planting crew. At the time of planting water is essential for transplant survival. It is recommended that overhead irrigation be combined with trickle irrigation during the first week, especially when hot or windy weather prevails. The vegetables require regular scouting for disease and insect presence during early establishment.

For detailed information concerning nutrient recommendations and the labeled herbicide, insecticide and fungicide options, obtain a copy of the University of Maryland Extension Bulletin 236: Commercial Vegetable Production Recommendations, (revised annually). The implementation of IPM practices during the University of Maryland research trials led to the achievement of project goals of highly marketable fruit, leafy greens and herbs. The research plots were also very aesthetic and would make an attractive addition as a market garden or U-pick when placed in proximity to on farm retail stands.

This market garden approach may also be substantially augmented by utilizing season extension technologies. Plasticulture systems that utilize early spring and late fall in-field high tunnels and over-the-row low tunnels can significantly expand the market window. Growers in Southern Maryland have adopted these techniques readily and should be encouraged to always consider adding new vegetable and herb varieties. For more information on season extension technologies obtain a copy of the University of Maryland Fact Sheet 760: Extending the Production Season for Vegetables and Small Fruit, (Butler and Ross 1999).
AMARANTH, Amaranthus species

*Amaranthus* sp. is a member of the Amaranthacea family

Other names: *Callalou* (Jamaica), *Bitekuteku* (DRC\(^1\)), and *Amarante* (France)

*Edible Red Amaranth, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: Stephan Tubene)*

**Origin and Botany**

Amaranths originated in Western Central and South America. They are better known for the grain producing species. Nevertheless, there are cultivars grown for leaves. Leafy vegetable amaranths are plants of African, Southeast Asian, and Central American origin, which include species such as *Amaranthus tricolor*, *A. lividus*, *A. dubius*, *A. gangeticus*, *A. blitum*, and *A. hybridus*.

**Market and Uses**

Leafy vegetable amaranths are usually sold in international specialty food stores in the U.S. Though imported from Asia, Africa, and Central America, vegetable amaranths are currently grown in the U.S. At the University of Maryland’s Research and Education Center, Upper Marlboro facility, scientists have reported yields of 21,143 pounds per acre. Amaranth leaves are a good source of protein, pro-vitamin A, vitamin C, and fiber. They are usually fried or cooked with tomatoes, onions and bell peppers, and served as a condiment with meat or fish. Young amaranth leaves are also served raw in a salad dish while amaranth seeds are used as ingredients in cereals.

**Culture**

The amaranth plants grow on a wide range of soils. Slightly acid sandy loams combined with a good drainage are preferred. Root systems are generally sparse. Like any tropical crop, amaranths are frost sensitive and require warm weather. They are, however, drought tolerant. Most leafy vegetable amaranths measure about 1-4 feet tall and produce numerous small flowers on terminal and auxiliary spikes. Although individual seed are very small, amaranth plants produce abundant edible seed, which have high protein and oil content. The grain amaranths are more productive seed producers than vegetable amaranths.

\(^1\)DRC stands for Democratic Republic of Congo
Disease concerns include leaf spot, and white rust caused by *Pythium*, and *Cercospora*. In addition, chewing insects such as striped amaranth beetle, and nematodes cause damage to amaranth plants, especially amaranth foliage.

**Propagating and Plant Spacing**

Vegetable amaranths are usually seed-propagated. However, seedlings can be used for transplants. Periodic applications of fertilizer are recommended to encourage vegetative growth and high yields. Amaranth’s grains left on the plants and falling on the ground could germinate during the following growing season. However, these seedlings are not a weed threat for farmers.

**Harvest and Post-harvest**

Vegetable amaranths are pulled with roots when they are 1-month old and thereafter. Another method consists of partial leaf removal intended to allow for re-growth of plants for successive harvesting. Frequent harvesting (weekly) tends to delay flowering and encourages new shoot and leaf growth. Post-harvest life of amaranth vegetables is relatively short due to rapid wilting of the foliage. Post-harvest handling consisting of a short cooling of leaves at 45-55 degree Fahrenheit before market delivery is recommended.
**BASIL, Ocimum basilicum**

*Ocimum basilicum* is a member of the Lamiaceae (mint) family

Other names: *Lumba lumba, Luenyi* (RDC), and *Basil* (France)

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*Basil Genovese, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: Stephan Tubene).*

**Origin and Botany**

Basil, an annual herb of the mint family, is a native to India and Asia. Basil plants grow in a bushy shape about 18 inches tall, with broad leaves 2 to 3 inches long. Leaves vary from yellow-green to dark green, depending on the variety and soil fertility. Basil is cultivated for its aromatic leaves, which are used both fresh and dried. Basil has a wide range of varieties including *Ocimum americanum* (lemon basil); *O. basilicum* (large-leaf green sweet basil popular for commercial use); Cinnamon (cinnamon basil; and *O. sanctum* (holy basil).

**Market and Uses**

Basil is grown commercially worldwide. It has medicinal, culinary, aromatic, ornamental, and cosmetic uses. Basil is used as a culinary seasoning and is widely known for its use in Italian, Indian, and Congolese cuisine. The cosmetics industry uses basil oil in lotions, perfumes, and soaps. Dried basil is used as an ingredient in potpourris. Basil foliage loses its aroma if stored too long after harvest.

**Culture**

Basil grows in a wide range of conditions including warm and temperate climate. In a temperate climate, basil seeds are sown in a greenhouse in spring and seedlings are transplanted to the field early summer. Cold weather turns the leaves limp and yellow. Basil is extremely sensitive to frost. Growth and yield vary depending on climate conditions, plant type, and cultural practices.
Propagation and Plant Spacing

Basil is direct seeded or transplanted to the field in late spring and/or early summer. A raised bed in a sandy-loam soil is recommended. Raised plasticulture beds fed by a trickle irrigation system have produced excellent results at the University of Maryland Research and Education Center. Space transplants every 5-6 inches in rows that are 24 to 36 inches apart. Basil can also be grown in high density if mechanical cultivation and direct seeding are possible. Fertilization depends on soil type and previous crop and fertilizer applications. An N-P-K ratio of 1-1-1 is recommended. Keeping the soil moist throughout the growing season will avoid low-moisture stress on basil vegetables.

Harvest and Post-harvest

Basil is harvested for fresh market by cutting foliage 5-6 inches above the ground in order to allow for re-growth. This will also restrict flowers from appearing too quickly. Frequent foliage harvest is encouraged. Basil foliage quality (for fresh market) is maintained by keeping standing bunched stems in clean water under ambient temperatures. Boxes containing basil may be kept in storage rooms below 50°F for short periods of time. Basil is also sold dry. To dry quickly, basil stalks are cut and spread on screens placed in direct sun.

Basil Genovese at CMREC, Upper Marlboro (Photos: Stephan Tubene)
CILANTRO, *Coriandrum sativum*

*Coriandrum sativum* is a member of the Apiaceae (parsley) family. Other names: *Joh tsu* (Hmong); *koendoro* (Japan); and *yun tsai* (China)

Cilantro, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photos: S. Tubene, and R. David Myers).

### Origin and Botany

Cilantro’s origin is eastern Mediterranean region and southern Europe. Cilantro is an annual plant that grows 2 to 3 feet tall. Cilantro’s leaves are light green, feathery, and flat. Its dried fruits, known as coriander seed are used as a spice.

### Market and Uses

Cilantro is grown for its fresh leaves and for its dried fruits. Cilantro leaves are used for flavor in culinary seasoning. Dried fruits, coriander seeds, are used (whole or ground) as spices. The seed's aromatic essential oil is extracted and used as ingredients in perfumes and cosmetics. Fresh cilantro roots are mixed with salad in a Thai cuisine.

### Culture

Cilantro grows in both warm and temperate weather. However, cilantro plants are sensitive to heat, and will bolt to seed quickly in warm weather. In a temperate climate, seeds are usually sown in a greenhouse during spring and transplanted in the field late spring or early summer. Plant spacing varies from 5 inches within rows to 35 inches between rows. As basil, cilantro will continue to produce new foliage after first cut until its goes to seed.

### Harvest and Post-harvest

For fresh market, basil is harvested 2–3 months after transplantation. Frequent harvesting is recommended in order to delay flowering and allow re-growth and more harvests. Fresh cilantro is kept cool at 50°F before market delivery. Large-scale commercial growers clip the plant just below ground level and bunch it. Coriander seeds are harvested when the entire plant is dried, before seed pods break open and scatter seed all over the ground.
**EGGPLANT, Solanum species**

*Solanum sp.* is a member of the Solanaceae family. Other names: *aubergine* (France), *njilu* (DRC), *gboma* (Togo)

*Thai eggplant*, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. *(Photo: R. David Myers)*

**Origin and Botany**

Eggplant originated in India. It was introduced to Africa by Arabic traders. Eggplant is widely popular in Asian, African, and Mediterranean countries. Eggplant is a member of *Solanacea* family. Varieties include *Solanum melongena* (round-shaped fruit), *S. esculentum* (egg-shaped fruit), and *S. macrocarpon* (*gboma* eggplant, West Africa). Eggplants are short-lived perennials in the tropics, and are cultivated as annuals in temperate zones. Leaves are generally large, alternate, and simple and have a dense grayish wooly covering under surface, particularly in wild types. Flowers are solitary or multiple in cyme inflorescence. The fruit is a large, pendent berry without a cavity. Fruit colors vary from white, yellow, green, red, purple, black, or mixtures of these colors. Seed are small and light brown, and imbedded in the placental tissues.

**Market and Uses**

Specialty eggplants are mainly sold in international grocery stores. Specialty eggplants include Thai eggplants, and garden eggs (African eggplants, also known as *gboma* in West Africa, and *njilu* in DRC). *Solanum gilo*, a *Solanacea* family’s specie, is grown for his bitter flavor. Specialty eggplants are known for their particular tastes and medicinal properties. Eggplants are usually fried and/or cooked in a stew dish along with meat or fish.
**Culture**

Eggplants are well adapted to tropical conditions and mid-temperate regions that provide a long period of continuous warm weather throughout growth. Favorable daytime temperatures range between 65°F and 85°F. Most soils are satisfactory; however, poorly drained soils should be avoided. A soil pH between 5.5 and 7.5 is preferred. Eggplants have a fairly high nutrient demand and supplemental fertilization is recommended.

**Propagation and Plant Spacing**

Eggplants are propagated by direct seeding or by transplants. Transplants are recommended in temperate climate. For production in severely diseased-infested soils, eggplants can be grafted to resistant rootstocks of *Solanum torvum* or *S. integrifolium*. Cultivars and cultural practices determine plant spacing requirements. Cultivars having large bushy growth are spaced further apart than dwarf types. Yields recorded at the University of Maryland Research and Education Center are 23,197 pounds per acre; 9,911 and 21,237 for Nadia, Zebra, and Kermit respectively.

**Harvest and Post-harvest**

Eggplants are harvested 3 months after seedlings were transplanted in the field. Under favorable conditions, flowering and fruit production is continuous. For best edible quality, fruits are consumed while immature and before seeds have enlarged. Eggplants are hand harvested with care without damaging the pedicel, which should be properly cut to prevent injuries to the plant. They can be stored in good marketable condition for 7-10 days at 55°F and 95% relative humidity.

*Zebra and Nadia eggplants*, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (*Photo: R. David Myers*)
AFRICAN EGGPLANT

African eggplants also known as garden eggs fit the same origin and botany as described above. The only distinctive characteristic of African eggplants is that their fruits are small, light and/or dark green when immature. It is at this stage that garden eggs are harvested. Left to mature on the plant, garden eggs become red and not suitable for consumption. Garden eggs are native of West Africa and nowadays almost disseminated in the African and Mediterranean region. They are grown like any other eggplants as described above. They are cooked as ingredients in most African cuisine stew and soup. African eggplants can be fried and served with meat and/or fish.

*African eggplants and okra,* Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. *(Photo: Stephan Tubene)*
PEPPER, Capsicum species

*Capsicum sp.* is a member of the Solanaceae family
Other names: *piment* (France); *pilipili, or ndungu* (DRC)

![Hot green pepper](image)

*Hot green pepper* (*Dutch Bonnet*), Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: R. David Myers)

**Origin and Botany**

Peppers’ origin is established in tropical and subtropical America. Peppers are herbaceous plants, mostly woody at the stem base. Taproots are strong and deep and generally well developed. Leaves have variable size. They are relatively smooth, simple and thin. Fruits are frequently borne singularly at each node for *C. annuum* cultivars, and with multiple fruit (typically two or three) per node for some other species. As fruits develop, the pericarp grows faster than placental tissues, resulting in a cavity. Fruit colors vary from green, yellow, purple when young to red, orange, yellow, or a mixture of these colors.

**Market and Uses**

Peppers are better known for their flavor. Pepper flavors range from sweet to mild and pungent. Varieties of peppers grown at the University of Maryland’s Research and Education Center, Upper Marlboro facility, are *Habanero*, and *Dutch Bonnet*. Pepper yields recorded at this research facility were estimated at about 8,500 pounds per acre. In many countries, peppers are considered an indispensable food. In fact, peppers not only add flavor to food, but they are also an excellent source of vitamins A and C. In addition, peppers are used for their medicinal characteristics mostly in Africa and Latin America as well as for ornamental purpose.
Culture

Peppers grow at various altitudes. They are frost and moisture sensitive. They require warm weather and a long growth period to be productive. Mean day temperatures of 68-78°F are ideal. Low temperatures coupled with excessive soil moisture delay growth, and limit flavor and color development. Lack of moisture during flowering may cause flowers and young fruit to abscise. Peppers should be planted in well-drained soils since waterlogged plants may lose foliage and become sensitive to root diseases. Most favorable soil pH ranges between 6.5 and 7.0.

Propagation and Plant Spacing

Peppers propagation is either direct seeding or transplants. Transplants propagation is the most commonly used practice. Seedlings are mainly grown in greenhouse and transplanted in the field when weather becomes favorable. Plant density varies with cultivars. Spacing is commonly 5-6 inches within rows and 32-36 inches between rows. Close spacing tends to reduce fruit size, although high densities provide shade that can limit fruit sunburn.

Harvest and Post-harvest

Fruit size and color as well as consumer tastes and preferences are common determinants of peppers harvest. Fruits are detached by carefully cutting through the pedicel in order to minimize stem breakage. Intact pedicel protects the fruits from drying out and becoming easily accessible to pathogens. Special care should be given to hot peppers (Habanero, and Dutch Bonnet) during harvest so as to avoid human injuries. Wearing plastic gloves will help prevent hand hitching. Post-harvesting handling consists of cooling fruits at 45-50°F in high relative humidity. Storage temperatures should be maintained above 40°F.

Hot pepper (Habanero) and Lantern (Habanero substitute in temperate climate), Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: Stephan Tubene)
**SWEET POTATO, *Ipomea batatas***

*Ipomea batatas* is a member of the Convolvulacea family.

Other names: *patate douce* (France); *matembele, or tshilunga* (DRC)

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*Edible sweet potato, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: Stephan Tubene).*

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**Origin and Botany**

Sweet potato’s origin is believed to be South America, West Indies, the Philippines and Polynesia. Sweet potato is a perennial dicotyledon known for its long trailing vines and smooth, flat, or lobed leaves, borne on erect petioles. Edible portions are the enlarged storage roots, shoot tips, and young leaves. *Ipomoea aquatica* is grown specifically for its edible foliage.

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**Market and Uses**

Sweet potato is grown for various uses including foliage and tuber consumption. Most edible sweet potato varieties have green lobed leaves. Shoot tips and young leaves can be eaten raw as a salad mixed with other vegetables such as spinach and amaranth mostly sold in international food stores. Young sweet potato foliage can also be cooked the same manner as spinach and served with a main dish.

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**Culture**

Sweet potato grows in various tropical, subtropical, and warm regions. Growth periods range from 90 to 150 days in temperate areas. In the tropics, growth is continuous and harvests can be made as needed for foliage, and for tubers whenever suitable root size is attained. Well-drained, sandy loam soils with adequate aeration are preferred. Soil compaction adversely affects storage root shape and size. Sweet potatoes have a moderate tolerance to low pH and are adaptable to a wide range of pH (4.5-7.5).
Propagation and Plant Spacing

Storage roots do not have natural dormancy and can therefore initiate adventitious sprouts whenever temperatures and moisture are favorable. In temperate regions, sprouts, also known as shoots usually grown in heated nursery beds, are used as seedling transplants, within a month of their growth. In tropical regions, however, vine shoot tips and stem cuttings are commonly used for propagation. Plant spacing depends on the intended use of the crop. For vegetable usage, wide spacing is recommended for large and abundant foliage production. Plantings are often established on raised beds to improve drainage and facilitate soil cover of developing storage roots.

Harvest and Post-harvest

When sweet potato is grown for foliage consumption, harvest occurs about six weeks after transplanting. In this case, leaves are harvested as vines expand. Several harvests are advised in order to encourage vines growth and therefore increase leaf yield. As vegetable, sweet potato leaves are harvested by cutting vines and cooling them at about 50°F before taking them to the market. If grown for tubers, it is not recommended to harvest foliage since it may delay storage roots’ growth with low yields as consequence.

_Edible sweet potato, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: Stephan Tubene)._
**TOMATILLO, *Physalis philadelphica***

*Physalis philadelphica* is a member of the Solanaceae (nightshade) family

Other names: *tomate* (French), and *tumata* (DRC)

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*Tomatillo Verde, Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: Stephan Tubene).*

**Origin and Botany**

The tomatillo plant’s origin is Mexico. It is an annual, low-growing, sprawling plant usually not more than 2 feet high. Tomatillo has small, sticky, tomato-like fruits enclosed in papery husks. Tomatillo is a highly variable crop in terms of plant habit, fruit size, and harvest date.

**Market and Uses**

Tomatillo is grown as traditional and/or organic specialty crop. Among tomatillo varieties, purple tomatillos are very distinctive. Tomatillos are mainly grown in Mexico and California. Tomatillo is widely used as a principal ingredient in green salsa, but also in soups and stews. Fruits that have turned yellow have low culinary value. Tomatillos are nutritious. They contain Vitamins A and C as well as niacin.

**Culture**

Tomatillo is grown in a warm-season region. It is fairly tolerant of drought. Tomatillos are grown the same way as tomatoes. They are generally direct-seeded. However, transplanting seedlings grown in advance in a green house is suitable for an early harvest. Plant spacing and population density vary considerably among growers. Flea beetles feed on tomatillos. Flea beetle’s symptoms on tomatillos are similar to those on tomatoes, except that the pests often eat right through the leaves, which are thinner than tomato leaves.
Harvest and Post-harvest

Tomatillo fruits are harvested 70 to 80 days after transplanting. Fruits are harvested selectively by hand as they mature. Maturity occurs when fruits begin to break through their husks. Harvest takes place before fruits turn yellow. Fruits can be stored at 55-60°F and 85-90% relative humidity.

*Sweet pepper (left) and Tomatillo Verde (right), Ethnic Vegetable Research Project at the Upper Marlboro Research and Education Center, University of Maryland. (Photo: R. David Myers).*
ETHNIC AND SPECIALTY VEGETABLE EXPECTED YIELDS

Based on the vegetable trials conducted from 2000 to 2001, expected yields of selected ethnic and specialty vegetables are summarized in Table 1 (R. David Myers, S. Tubene, et al., 2001).

Table 1. Ethnic Vegetable Yields (2000-2001)

<table>
<thead>
<tr>
<th>Vegetable Crop Species/Variety</th>
<th>Population (Plants/acre ppa) Spacing</th>
<th>Average Yield Harvested Portion (Pounds/plant)</th>
<th>Average Yield Harvested Portion (Estimated Pounds/acre)</th>
<th>Average Yield Harvested Portion (Estimated Tons/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaranth, Edible Green “Jamaican Calaloo”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves 7.625</td>
<td>Leaves 22,143</td>
<td>Leaves 11.07</td>
</tr>
<tr>
<td>Amaranth, Edible Red “Jamaican Calaloo”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves 5.750</td>
<td>Leaves 16,698</td>
<td>Leaves 8.35</td>
</tr>
<tr>
<td>Sweet Pepper, Green/Red Bell “King Arthur”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 6.750</td>
<td>Fruit 19,602</td>
<td>Fruit 9.80</td>
</tr>
<tr>
<td>Sweet Pepper, Red Pimento “Pimento Elite”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 1.938</td>
<td>Fruit 5,628</td>
<td>Fruit 2.81</td>
</tr>
<tr>
<td>Hot Pepper, Cayenne “Mesilla”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 5.250</td>
<td>Fruit 15,246</td>
<td>Fruit 7.62</td>
</tr>
<tr>
<td>Hot Pepper, Ornamental “Numex”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 3.250</td>
<td>Fruit 9,438</td>
<td>Fruit 4.72</td>
</tr>
<tr>
<td>Hot Pepper, African/Jamaican “Dutch Bonnet”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 3.125</td>
<td>Fruit 9,075</td>
<td>Fruit 4.54</td>
</tr>
<tr>
<td>Hot Pepper, Green Habanero</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 1.000</td>
<td>Fruit 2,904</td>
<td>Fruit 1.45</td>
</tr>
<tr>
<td>Hot Pepper, Red Habanero</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 2.725</td>
<td>Fruit 7,913</td>
<td>Fruit 3.96</td>
</tr>
<tr>
<td>Hot Pepper, Orange Habanero</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 1.938</td>
<td>Fruit 5,628</td>
<td>Fruit 2.81</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vegetable Crop Species/Variety</th>
<th>Population (Plants/acre ppa) Spacing</th>
<th>Average Yield Harvested Portion (Pounds/plant)</th>
<th>Average Yield Harvested Portion (Estimated Pounds/acre)</th>
<th>Average Yield Harvested Portion (Estimated Tons/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet Potato “Red Hayman”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves &amp; Petioles 13.038</td>
<td>Leaves &amp; Petioles 37,862</td>
<td>Leaves &amp; Petioles 18.93</td>
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<tr>
<td>Cucumber, Asian “Suyo Long”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 14.80</td>
<td>Fruit 42,979</td>
<td>Fruit 21.49</td>
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<tr>
<td>Tomatillo, Green “Tomato Verde”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 8.388</td>
<td>Fruit 24,359</td>
<td>Fruit 12.18</td>
</tr>
<tr>
<td>Tomatillo, Purple “Purple”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 11.100</td>
<td>Fruit 32,234</td>
<td>Fruit 16.12</td>
</tr>
<tr>
<td>Eggplant, Black Oblong “Nadia”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 7.988</td>
<td>Fruit 23,197</td>
<td>Fruit 11.60</td>
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<tr>
<td>Eggplant, Purple Striped Oblong “Zebra”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 3.413</td>
<td>Fruit 9,911</td>
<td>Fruit 4.96</td>
</tr>
<tr>
<td>Eggplant, Green Striped Round “Kermit”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Fruit 7.313</td>
<td>Fruit 21,237</td>
<td>Fruit 10.62</td>
</tr>
<tr>
<td>Leek “Upton”</td>
<td>17,424 ppa 5’ X 12” X 12”</td>
<td>Leaves &amp; Bulb 0.360</td>
<td>Leaves &amp; Bulb 6,273</td>
<td>Leaves &amp; Bulb 3.14</td>
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<tr>
<td>Spinach, Smooth Leaf “Denali”</td>
<td>17,424 ppa 5’ X 12” X 12”</td>
<td>Leaves 0.280</td>
<td>Leaves 4,879</td>
<td>Leaves 2.44</td>
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<tr>
<td>Cilantro “Jantor”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves 1.875</td>
<td>Leaves 5,445</td>
<td>Leaves 2.72</td>
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<tr>
<td>Chervil “Brussels”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves 0.500</td>
<td>Leaves 1,452</td>
<td>Leaves 0.73</td>
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<tr>
<td>Sweet Basil “Genovese”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves 3.000</td>
<td>Leaves 8,712</td>
<td>Leaves 4.36</td>
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<tr>
<td>Holy Basil, Green “Kaprao” Thailand</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves 0.700</td>
<td>Leaves 2,033</td>
<td>Leaves 1.02</td>
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<tr>
<td>Basil, Purple “Osmin Purple”</td>
<td>2,904 ppa 5’ X 36”</td>
<td>Leaves 0.233</td>
<td>Leaves 677</td>
<td>Leaves 0.34</td>
</tr>
</tbody>
</table>
SEED SOURCES

W. Atlee Burpee & Co., 300 Park Avenue, Warminster, PA 18974
The Cooks Garden, P.O. Box 65, Londonderry, VT 05148
Johnny's Selected Seeds, Foss Hill Road, Albion, ME 04910
Le Jardin du Gourmet, P.O. Box 75, St. Johnsbury Center, VT 05863
Native Seeds, 2509 N. Campbell Avenue #325, Tucson, AZ 85719
Nichols Garden Nursery, 1190 North Pacific Highway, Albany, OR 93721
Park Seed Company, Cokesbury Road, Greenwood, SC 29647-0001
Seeds Blüm, Idaho City Stage, Boise, ID 83706
Shepherd's Garden Seeds, Shipping Office, 30 Irene Street, Torrington, CT 06790
Sunrise Enterprises, P.O. Box 10058, Elmwood, CT 06110-0058
Taylor's Herb Gardens, 1535 Lone Oak Road, Vista, CA 92084
W. Atlee Burpee & Co., 300 Park Avenue, Warminster, PA 18974
Nichols Garden Nursery, 1190 North Pacific Highway, Albany, OR 93721
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REFERENCES


1For educational purpose only.